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**NEER Grant: DE-FG07-98ID13632**  
**Final report**

**Title:** Reactor whole core transport calculations without fuel assembly homogenization

**Investigator:** Nicholas Tsoulfanidis, University of Missouri-Rolla

**Co-Investigator:** Elmer Lewis, Northwestern University

**Funding period:** 9-1-98 to 8-31-01

**General Objective:** Numerical algorithms developed to serve as the basis for the next generation of computer codes to perform accurate 3D core physics calculations.

The two-dimensional form of a finite element formulation of VARIANT has been refined to accept higher order angular approximations and more elaborate finite element representations in 2 and 3D formulations.

Papers presented in national and international meetings, based on this grant, or in preparation

1. "Whole –core neutron transport calculations without cross section homogenization", Proceedings ICONE 8 International conference on Nuclear Engineering, April 2-6, 2000, Baltimore, MD, USA.
2. "Whole-core neutron transport calculations without fuel-coolant homogenization", PHYSOR-2000, Pittsburgh, PA, USA.
3. " Neutron transport validation of variational nodal subelement methods", Proc. Fourth Int. Conf. Supercomputing in Nuclear Applications, Tokyo, Sept. 4-7, 2000, SNA-2000.
4. " Comparison of angular approximations for PWR cell calculations", ANS Trans., 84, p.90, June 2001.
5. " Implementation of the finite element approximation within the variational nodal framework to allow for whole-core heterogeneous reactor physics calculations", in preparation to be submitted to Nuclear Science and Engineering, Nov. 2001.

MS Thesis of M. Smith " Implementation of the finite element method in a nodal transport program to allow for heterogeneous geometries", May 2000

Ph. D., Dissertation of M. Smith, " A 3-D nodal neutron transport program with the ability to handle spatial heterogeneities", October 2001.

Benchmark problem participation: NEA Benchmark on deterministic 2-D/3-D MOX fuel assembly transport calculations without spatial homogenization (C5G7 MOX).